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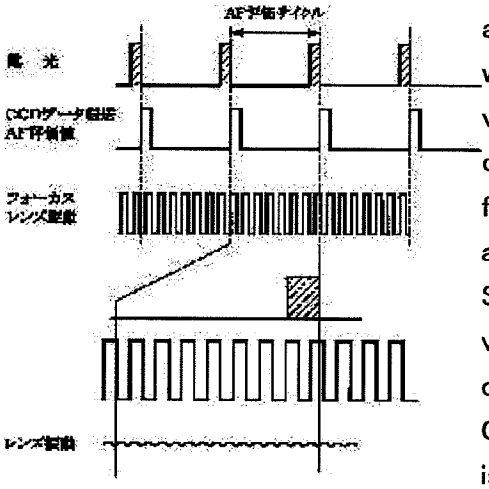
(54) AUTOFOCUS METHOD AND AUTOFOCUS DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To provide an autofocus method and an autofocus device by which the peak position of an AF evaluated value can be detected in a shorter time without drastically lowering the detecting accuracy of a focusing position in contrast detection type autofocus control.

SOLUTION: In a system, the AF evaluated value is calculated based on a high frequency component included in an output signal from a CCD at respective positions while a focus lens is moved in an optical axis direction by a stepping motor, and the focus lens is moved to the peak position where the AF evaluated value is the largest. The focus lens is continuously moved within a searching range and exposure is performed by the CCD in a specified cycle in course of the movement of the focus lens. By shortening an AF evaluation cycle for acquiring the AF evaluated value, the speed-up of autofocus operation is realized. Besides, since the vibration of

the focus lens is not increased for every AF evaluation cycle, the operation noise of the focus lens at the time of autofocus control is decreased.

CLAIMS

[Claim(s)]

[Claim 1]Perform exposure by an image sensor, moving an optical system to an optical axis direction, and AF rating value based on a picture signal outputted from an image sensor is acquired, An autofocus method characterized by performing exposure by said image sensor intermittently during movement of said optical system while continuing and moving said optical system to an optical axis direction on the occasion of autofocus control which controls a position of an optical system based on acquired AF rating value.

[Claim 2]The autofocus method according to claim 1 characterized by performing exposure by said image sensor intermittently during movement of said optical system while continuing and moving said optical system to an optical axis direction on the occasion of position control near the focusing position before position control to a focusing position of said optical system.

[Claim 3]The autofocus method according to claim 1 or 2 synchronizing with periodic driving timing when continuing and moving said optical system to an optical axis direction timing of exposure performed with a given period with said image sensor during movement of said optical system.

[Claim 4]An automatic focusing device which performs exposure by an image sensor, moving an optical system characterized by comprising the following to an optical axis direction, acquires AF rating value based on a picture signal outputted from an image sensor, and controls a position of an optical system based on acquired AF rating value. The 1st movement control means that continues and moves said optical system to an optical axis direction via a driving means.

The 1st exposure control means that makes exposure by said image sensor perform intermittently during movement of said optical system accompanying control of said driving means in this movement control means.

[Claim 5]The 1st position control means that moves an optical system near the focusing position via said driving means based on two or more AF rating value acquired by exposure intermittently performed by said 1st exposure control means characterized by comprising the following, Stopping timing under intermittent movement of said optical system accompanying control of the 2nd movement control means that moves said optical system to an optical axis direction intermittently via said driving means [near said focusing position], and said driving means in this 2nd movement control means.
The 2nd exposure control means exposure by said image sensor is made to perform.
The 2nd position control means that moves an optical system to a focusing position via said driving means based on two or more AF rating value acquired by exposure intermittently performed by this 2nd exposure control means.

[Claim 6]By driving said optical system periodically by said driving means, continue and move said 1st movement control means to an optical axis direction, and said optical system said 1st exposure control means, The automatic focusing device according to claim 4 or 5 making it synchronize with periodic driving timing of said optical system by said driving means, and making exposure by said image sensor perform with a predetermined cycle.
[Claim 7]Perform exposure by an image sensor, moving an optical system to an optical axis direction, and AF rating value based on a picture signal outputted from an image sensor is acquired, A movement control means which continues said optical system to an optical axis direction, and moves a computer which an automatic focusing device which controls a position of an optical system based on acquired AF rating value has to it via a driving means, A program for making it function as an exposure control means to make exposure by said image sensor perform intermittently during movement of said optical system accompanying control of said driving means in this movement control means.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention is used for camera devices, such as a digital camera, and relates to a suitable autofocus method and an automatic focusing device.

[0002]

[Description of the Prior Art]Conventionally, a photographic subject is picturized using the solid state image pickup device of a CCD type or an MOS type, and many contrast detection systems are adopted as the autofocus control (AF control) of the digital camera which changes it into image data and records it. This method is adopted also in the digital camcorder, the film-based camera which uses CCD as sensors, etc. In a contrast detection system, it exposes in each position, moving a focus lens to an optical axis direction intermittently with a stepping motor, and AF rating value is computed based on the high frequency component contained in output signals (imaging signal), such as CCD. And it judges the peak position which becomes the largest to be a focusing position, and moves a focus lens to the position.

[0003]As shown, for example in drawing 6, in actual control at the beginning of a control start by the outline search with 1 time of large movement magnitude of a focus lens. Lens movement and exposure (AF-rating-value calculation) are repeated towards a counter direction from the single-sided end of the search range of a focus lens, and near the peak (a near focusing position) of AF rating value is once become final and conclusive. A detailed search with 1 time of small (1 - number step) movement magnitude of a focus lens is performed near the settled peak after an appropriate time, and the peak position (focusing position) of AF rating value is become final and conclusive from the distribution state of the AF rating value in near a peak. Thereby, improvement in the speed of focus doubling is attained. During the search operation through the near [a peak] decision period which performs an outline search, and the focus position decision period which performs a detailed search, Transmission of the CCD data accompanying [as shown in drawing 7 and drawing 8] the last exposure, calculation of AF rating value, and movement of the focus lens which was parallel with it, Processing which elects a peak position based on the AF rating value of a number of points acquired in it two or more cycle repetition and in the meantime is performed by making into AF evaluation cycle convergence waiting (period shown in the figure by W) of vibration of the focus lens after a stop of a focus

lens and a stop, and the next exposure.

[0004]

[Problem(s) to be Solved by the Invention]However, if it is in the autofocus method mentioned above, whenever a focus lens stops during a search operation, the period W of the waiting for oscillating convergence as which the vibration is completed is indispensable, and one acquisition of AF rating value takes time. For this reason, there was a limit also in improvement in the speed of automatic focusing operation.

[0005]Of course, if oscillating convergence time after a focus lens stop is shortened, the acquisition time of AF rating value can be shortened, but it is necessary to fully secure oscillating convergence time. When the backlash of the drive mechanism of the focus lens which used the stepping motor as the actuator is large, this, When the oscillating convergence period W exceeds AF evaluation cycle period, it is for adding the noise component by vibration to the AF rating value to detect, and making the detecting accuracy of a peak position, i.e., a focusing position, fall substantially.

[0006]This invention is made in view of this conventional technical problem, and is a thing.

The purpose is to provide the autofocus method which becomes accelerable [automatic focusing operation], and an automatic focusing device, without reducing detecting accuracy substantially.

[0007]

[Means for Solving the Problem]If it is in an invention of claim 1 in order to solve said technical problem, Perform exposure by an image sensor, moving an optical system to an optical axis direction, and AF rating value based on a picture signal outputted from an image sensor is acquired, While continuing and moving said optical system to an optical axis direction on the occasion of autofocus control which controls a position of an optical system based on acquired AF rating value, it was considered as a method of performing exposure by said image sensor intermittently during movement of said optical system.

[0008]Whenever it acquires AF rating value, an optical system is not made to produce vibration every in this method, in order to perform exposure by an image sensor in parallel to it, while an optical system is moving. Therefore, it is not necessary to secure an oscillating convergence period of an optical system when acquiring AF rating value, and shortening of time which one acquisition of AF rating value takes is attained. And since an optical system continues and is moved, vibration generated by movement becomes small.

[0009]If it was in an invention of claim 2, while continuing and moving said optical system to an optical axis direction on the occasion of position control near the focusing position before position control to a focusing position of said optical system, it was considered as a method of performing exposure by said image sensor intermittently during movement of said optical system.

[0010]According to this method, on the occasion of position control near the focusing position of an optical system, shortening of time which one acquisition of AF rating value takes is attained.

[0011]If it was in an invention of claim 3, timing of exposure performed with a given period with said image sensor during movement of said optical system was made into a method of synchronizing with periodic driving timing when continuing and moving said optical system to an optical axis direction.

[0012]According to this method, influence of a noise resulting from vibration of an optical system included in each AF rating value repeatedly acquired during movement of an optical system is equalized. Therefore, accuracy of position control near the focusing position before position control to a focusing position of an optical system or position control to a focusing position can be raised.

[0013]If it is in an invention of claim 4, exposure by an image sensor is performed moving an optical system to an optical axis direction, In an automatic focusing device which acquires AF rating value based on a picture signal outputted from an image sensor, and controls a position of an optical system based on acquired AF rating value, It should have the 1st exposure control means exposure by said image sensor is made to perform intermittently during movement of said optical system accompanying control of the 1st movement control means that continues and moves said optical system to an optical axis direction via a driving means, and said driving means in this movement control means.

[0014]In this composition, while an optical system is continued and moved to an optical axis direction by the 1st movement control means and an optical system is moving, in parallel to it, exposure by an image sensor is intermittently performed by the 1st exposure control means. And AF rating value based on a picture signal outputted from an image sensor in connection with it is acquired, and a position of an optical system is controlled based on acquired AF rating value. Therefore, it is not necessary to secure an oscillating convergence period of an optical system when acquiring AF rating value, and time which one acquisition of AF rating value takes becomes short. And accuracy does not fall substantially. And since an optical system continues and is moved, vibration generated by movement of an optical system

becomes small.

[0015]The 1st position control means that moves an optical system near the focusing position via said driving means based on two or more AF rating value acquired by exposure intermittently performed by said 1st exposure control means if it is in an invention of claim 5, The 2nd movement control means that moves said optical system to an optical axis direction intermittently via said driving means [near said focusing position], In stopping timing under intermittent movement of said optical system accompanying control of said driving means in this 2nd movement control means, It should have the 2nd exposure control means exposure by said image sensor is made to perform, and the 2nd position control means that moves an optical system to a focusing position via said driving means based on two or more AF rating value acquired by exposure intermittently performed by this 2nd exposure control means.

[0016]In this composition, while said optical system is continued and moved to an optical axis direction on the occasion of position control near the focusing position, exposure by an image sensor is intermittently performed during movement of an optical system. Therefore, position control can be performed at high speed near the focusing position of an optical system. Then, an optical system moved near the focusing position is moved to a focusing position based on two or more AF rating value acquired by exposure intermittently performed by an image sensor in stopping timing under the movement while being further moved to an optical axis direction intermittently. That is, an optical system moved near the focusing position is moved to a focusing position by the same technique as usual.

[0017]If it is in an invention of claim 6, said 1st movement control means, Continuing and moving said optical system to an optical axis direction, said 1st exposure control means is synchronized with periodic driving timing of said optical system by said driving means, and makes exposure by said image sensor perform with a predetermined cycle by driving said optical system periodically by said driving means.

[0018]In this composition, influence of a noise resulting from vibration of an optical system included in each AF rating value repeatedly acquired during movement of an optical system is equalized. Therefore, accuracy of position control near the focusing position before position control to a focusing position of an optical system or position control to a focusing position can be raised.

[0019]If it is in an invention of claim 7, exposure by an image sensor is performed moving an optical system to an optical axis direction, A computer which an automatic focusing device which acquires AF rating value based on a picture signal outputted from an image sensor, and controls a position of an optical system based on acquired

AF rating value has, It was considered as a program for making it function as an exposure control means to make exposure by said image sensor perform intermittently during movement of said optical system accompanying control of a movement control means which continues and moves said optical system to an optical axis direction via a driving means, and said driving means in this movement control means.

[0020]

[Embodiment of the Invention]Hereafter, the 1 embodiment of this invention is described according to figures.

(A 1st embodiment) Drawing 1 is a block diagram of the digital camera 1 in which the 1 embodiment of this invention is shown. This digital camera 1 is provided with AF function by the contrast detection system which carried out the existing theory by conventional technology. The digital camera 1, The focus lens 2, the zoom lens 3, CCD4, the CDS/AD block 5, TG(Timing Generator) 6, the CCD data preprocessing block 7, the color processing (CP) block 8, the JPEG coding machine 9, DRAM10, ROM11, RAM12, CPU13, It has the picture display part 14, the key blocks 15, the card interface 16, and the motor drive block 17, and the memory card 18 with which the card slot of the camera body which is not illustrated was equipped enabling free attachment and detachment is connected to the card interface 16.

[0021]The focus lens 2 and the zoom lens 3 comprise a lens group which each does not illustrate.The focal motor 170a by which the motor drive block 17 drives the focus lens 2 to an optical axis direction, and the zoom motor 170b which drives the zoom lens 3 to an optical axis direction, It comprises Motor Driver 171a and 171b which drives the focal motor 170a and the zoom motor 170b according to the control signal sent from CPU13, respectively. The focal motor 170a and the zoom motor 170b are stepping motors, and move precisely the focus lens 2 and the zoom lens 3 on an optic axis by carrying out step drives with the control signal sent from CPU13. In this embodiment, the focus lens 2 is an optical system of this invention, and the focal motor 170a and Motor Driver 171a are the driving means of this invention.

[0022]CCD4 carries out photoelectric conversion of the object image projected via the focus lens 2 and the zoom lens 3, and it outputs it as an imaging signal. TG6 generates the timing signal of predetermined frequency and it drives CCD4. The CDS/AD block 5 changes an imaging signal into a digital signal while removing a noise from the output signal from CCD4. The CCD data preprocessing block 7 performs data processing, such as luminance-signal processing, to the imaging signal changed into the digital signal. The color processing (CP) block 8 performs color processings, such

as color separation, to the picture signal with which luminance-signal processing etc. were performed, and generates the image data of Y, Cb, and Cr. DRAM10 memorizes the image data of Y after color processing, Cb, and Cr one by one.

[0023]Where the picture display part 14 was set to color LCD from the drive circuit etc. which drive it and photographing mode is set up, while the shutter key is not pressed (photographing standby state), The through picture based on the image data for one frame (screen) which was incorporated from CCD4 and accumulated in DRAM10 is displayed, and where reproduction mode is set up, the recorded image based on the image data elongated while being read from the memory card 18 is displayed. The JPEG coding machine 9 carries out JPEG compression of the image data inputted from the color processing (CP) block 7 at the time of image recording. The memory card 18 records the image data after the compression sent via the card interface 16. In the picture display part 14, the recorded image data is displayed, after being read at the time of reproduction of a recorded image and being elongated with the JPEG coding machine 9.

[0024]The key blocks 15 send the manipulate signal according to key operation to CPU13 including the change key and various kinds of operation keys, such as a shutter key, which are used for the change of operation to photographing mode and reproduction mode. CPU13 operates considering RAM12 as an operating memory according to the manipulate signal from the key blocks 15, and a predetermined control program, and controls operation of the whole digital camera 1. The various data needed for various kinds of control by CPU13, i.e., AF control, AE control, and AWB control with the above-mentioned control program is stored in ROM11. And CPU13 functions by operating according to the above-mentioned control program as the 1st and 2nd movement control means of this invention, the 1st and the 2nd exposure control means, and the 1st and 2nd position control means. The above-mentioned control program may be the composition which does not necessarily need to be stored in ROM11, for example, was stored in the predetermined region of said memory card 18. If it is the composition provided with the rewritable memory of EEPROM etc. besides said memory card 18, the above-mentioned control program is good also as composition supplied to those memories by arbitrary methods, such as communication, from other devices.

[0025]Next, it explains according to the flow chart which shows the photographing processing procedure by CPU13 which showed drawing 2 operation concerning this invention of the digital camera 1 which consists of the above composition.

[0026]When photographing mode is set up by the user, CPU13 starts processing and

distinguishes whether the shutter key was half-pressed (Step S1). If a shutter key is half-pressed (it is YES at Step S1), processing which starts an outline search at Step S2 - Step S6 will be performed. Drawing 3 is a timing chart which shows operation of the digital camera 1 when the outline search is performed. In an outline search, CPU13 starts the continuation drive of the focal motor 170a first (Step S2). Thereby, the focus lens 2 is continued and moved towards a counter direction from a single-sided end in the focusing search ranges (1m-infinity etc.) decided beforehand. If a predetermined exposure stage arrives at the meantime (Step S3), processing which drives exposing treatment, i.e., CCD, 4 and takes out the picture signal according to an object image will be performed (step S4). AF rating value is computed based on the high frequency component to which transmission processing which incorporates a picture signal as CCD data at this time is also performed and which is further contained in a picture signal (Step S5). Here, while integrating with one field period of high frequency components contained in a described image signal, for example and making the result into AF rating value, calculation which removes the noise contained in it is performed.

[0027]And calculation of the exposing treatment mentioned above and AF rating value is periodically repeated until the focus lens 2 reaches the lens ends (infinity etc.) of the focusing search range (it is NO at Step S6) (Step S3 - Step S5). Two or more two or more AF rating value when it is in the position from which the focus lens 2 differs by this is acquired. When the focus lens 2 reaches the lens ends (infinity etc.) of the focusing search range soon (it is YES at Step S6), The most expensive AF rating value is detected in two or more AF rating value acquired at the time, near a peak (a near focusing position) is distinguished based on the lens position which acquired the detected AF rating value (Step S7), and the focus lens 2 is moved to the position (Step S8). When processing which detects the peak of AF rating value is performed and a peak is detected, carrying out an outline search, without moving the focus lens 2 to lens ends (infinity etc.), it may be made to stop movement of the focus lens 2.

[0028]Then, CPU13 performs processing which starts a detailed search at step S9 - Step S13. The detailed search is the same as that of the method explained by conventional technology, and it is near the peak of AF rating value, Only fine movement magnitude (1 - number step) moves the focus lens 2 by the focal motor 170a (step S9), exposing treatment is performed (Step S10), and AF rating value is computed (Step S11). It repeats until calculation of the AF rating value in the whole region near a peak completes this (being Step S12 NO). That is, the processing which acquires AF rating value in each stop position is repeated, moving the focus lens 2

intermittently. Soon, when the AF rating value in the whole region near a peak is acquirable (it is YES at Step S12), The peak position (focusing position) of AF rating value is determined from the distribution state of the AF rating value acquired near the peak (Step S13), and the focus lens 2 is moved to the determined position (Step S14). This completes AF control.

[0029]and when the shutter key was pressed fully (it is YES at Step S15), the object image was incorporated as a picture signal by photographing processing — back (Step S16) — it records on the memory card 18 by making an object image into image data by recording processing (Step S17), and one photographing processing is ended.

[0030]While continuing and moving the focus lens 2 in this embodiment here on the occasion of the outline search (Steps S2–S6) mentioned above, in order to perform exposing treatment by CCD4 in parallel to it, As shown in drawing 3, vibration of the focus lens 2 does not increase just before exposing treatment, and it is not necessary to secure the period W of the waiting for oscillating convergence (drawing 8) explained by conventional technology within the period, i.e., AF evaluation cycle, which acquires AF rating value. Therefore, it becomes possible to be shortened till time (for example, around 33.3 ms) required for the exposing treatment which mentioned AF evaluation cycle above. As a result, as shown in drawing 4, by shortening period, i.e., outline search period, t which decision near the peak of the AF rating value within an AF control period takes, 1 time of the AF control time T can be shortened, and improvement in the speed of automatic focusing operation can be attained.

[0031]And since vibration of the focus lens 2 does not increase for every AF evaluation cycle, vibrational frequency produced in the focus lens 2 can be carried out below the resonance point of the focal motor 170a. Therefore, the operation sound of the focus lens 2 grade in an outline search period can be reduced.

[0032]In this embodiment, since the detailed search which becomes final and conclusive the peak position of AF rating value is performed by the same method as the former after performing an outline search, improvement in the speed of AF control can be attained, without completely reducing final autofocus control precision. The characteristic of optical systems for example, such as the focus lens 2 and the zoom lens 3, The case where it is what can secure a practical focusing state even if it is a time of a regular focusing position and slight gap having arisen in the position of the focus lens 2 temporarily, Can reduce the vibration under movement of the focus lens 2 until the influence of the noise reflected in the AF rating value resulting from it becomes very small, or, When it is possible to cancel the influence of a noise when computing AF rating value, the AF control which excluded the detailed search

mentioned above becomes possible. Namely, the same operation as the outline search which shortened AF evaluation cycle (exposure time) to the maximum extent, and mentioned it above is performed, Where the focus lens 2 is continued and moved, the peak position of AF rating value is detected, and it becomes possible also for moving the focus lens 2 by making the position into a focusing position to realize auto-focusing.

[0033]The operation in this embodiment is feasible only by changing the control program of CPU13 for the mechanical constitution of the digital camera 1 as in the conventional state. Therefore, if it is the composition which can change the control program about AF control, it is possible to carry out this invention easily also in the preexisting digital camera.

[0034](A 2nd embodiment), next a 2nd embodiment of this invention are described. On the occasion of the processing which this embodiment requires for the outline search in Step S2 – Step S6 which were explained by drawing 2 in a 1st embodiment, CPU13 performs exposing treatment of step S4 to the following timing.

[0035]Namely, in [drawing 5 is a figure corresponding to drawing 3, and] the outline search of this embodiment, As the driving timing of the focus lens 2 is always in agreement by the start timing and the focal motor 170a of AF evaluation cycle which were mentioned above, exposure of CCD4 is performed according to the driving period (drive pulse) of the focus lens 2. That is, the time relation of the drive of the focus lens 2 and the exposure of CCD4 which are performed a different cycle is exposed to the timing which becomes fixed. Or the focus lens 2 is moved with the driving speed which becomes constant [the time relation of the drive of the focus lens 2 and the exposure of CCD4 which are performed a different cycle]. About the processing of those other than this, it is the same as that of a 1st embodiment.

[0036]In this embodiment, since the noise resulting from the vibration under movement of the focus lens 2 contained in AF rating value is equalized for every AF evaluation cycle, the accuracy of an outline search can be raised. therefore, detailed search **** carried out following an outline search -- it becomes possible to attain much more improvement in the speed of automatic focusing operation by one further shortening of the AF control time T by narrowing the range near the peak of the AF rating value which should be searched.

[0037]When performing AF control which excluded the detailed search explained by a 1st embodiment, even if it carries out, the above-mentioned processing in this embodiment is effective, and in that case, By raising the accuracy of the AF rating value acquired in each AF evaluation cycle, it becomes possible to raise control

precision autofocus as a result.

[0038]Although the case where this invention was adopted as a digital camera was explained in the above explanation, The image sensor of CCD and others may be used as a sensor, it may be adopted as other camera devices which perform AF control of a contrast detection system, and the same effect as this embodiment is acquired also in such a case.

[0039]

[Effect of the Invention]As explained above, in the method and device of this invention, it is not necessary to secure the oscillating convergence period of an optical system when acquiring the AF rating value in autofocus control, and shortening of the time which one acquisition of AF rating value takes is attained. Therefore, improvement in the speed of automatic focusing operation can be attained. And since an optical system continues, and is moved and vibration generated by movement becomes small, operation sounds, such as an optical system at the time of automatic focusing operation, can be reduced.

[0040]It was made for shortening of the time which acquisition of each AF rating value takes to be attained on the occasion of the position control near the focusing position of an optical system. Therefore, improvement in the speed of automatic focusing operation can be attained by accelerating the position control near the focusing position of an optical system. And since the same technique as usual is used on the occasion of the position control to the focusing position of the continuing optical system, it is also possible to control an optical system by the completely same accuracy as the former to a focusing position.

[0041]The influence of the noise resulting from vibration of an optical system included in each of the AF rating value repeatedly acquired during movement of an optical system was equalized. Therefore, the accuracy of the position control near the focusing position before the position control to the focusing position of an optical system or the position control to a focusing position can be raised. As a result, it becomes possible to be high-speed and highly precise and to perform automatic focusing operation.

[0042]In the automatic focusing device which has a computer, operation of the method of this invention and a device is attained by using the program of this invention. Also in the preexisting automatic focusing device, it becomes possible.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a block lineblock diagram showing the important section of the digital camera common to each embodiment of this invention.

[Drawing 2]It is a flow chart which shows the photographing processing procedure by CPU of a 1st embodiment.

[Drawing 3]It is a timing chart which shows the operation within the outline search period in the embodiment.

[Drawing 4]It is a timing chart which shows the operation about the autofocus control in the embodiment.

[Drawing 5]It is a timing chart which shows the details of the focusing search operation in a 2nd embodiment of this invention.

[Drawing 6]It is a timing chart which shows the operation about the autofocus control in a Prior art.

[Drawing 7]It is a figure showing the relation of the lens position and AF rating value in a Prior art, and the operation within an outline search period.

[Drawing 8]It is a timing chart which shows the details of the operation within the outline search period in a Prior art.

[Description of Notations]

1 Digital camera

2 Focus lens

4 CCD

11 ROM

12 RAM

13 CPU

17 Motor drive block

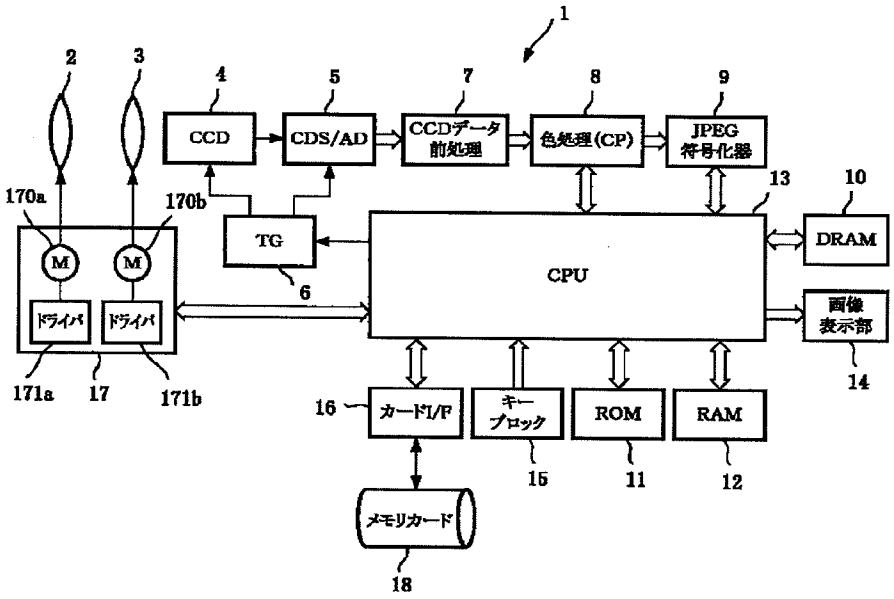
18 Memory card

170a A focal motor

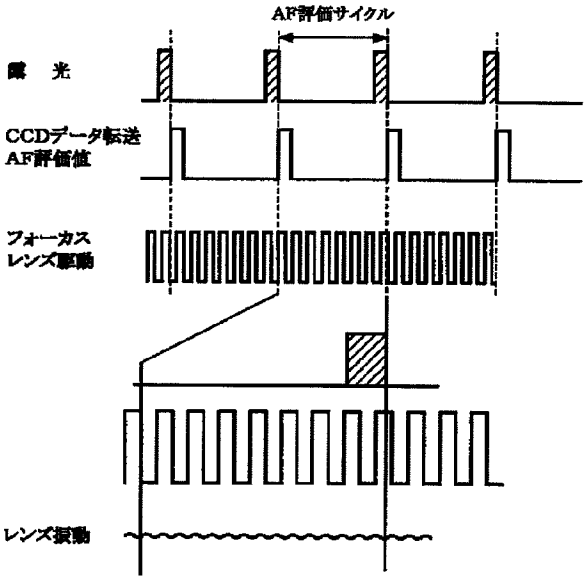
171a Motor Driver

DRAWINGS

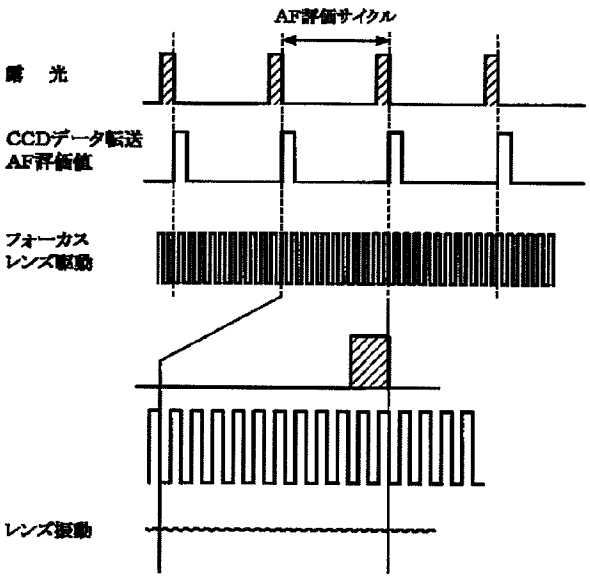
[Drawing 1]



[Drawing 3]



[Drawing 5]



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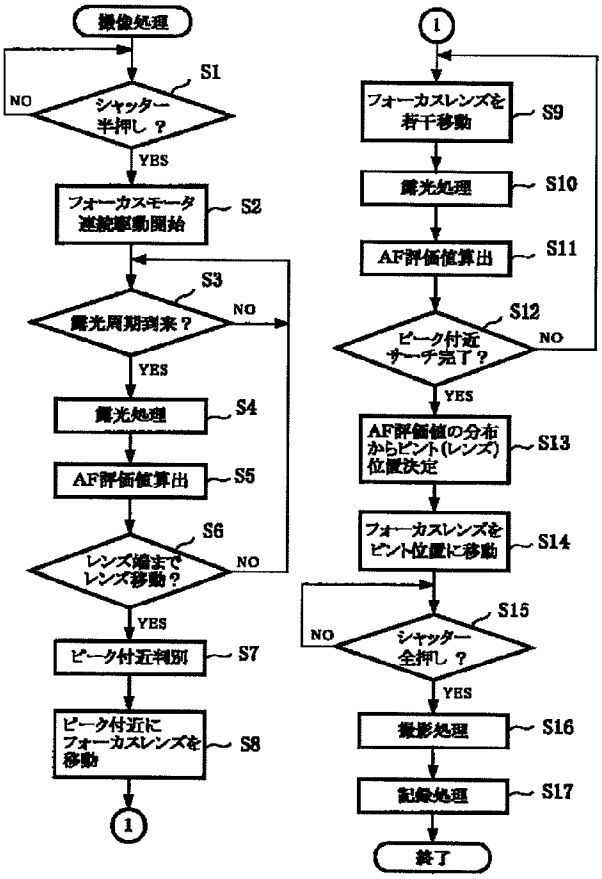

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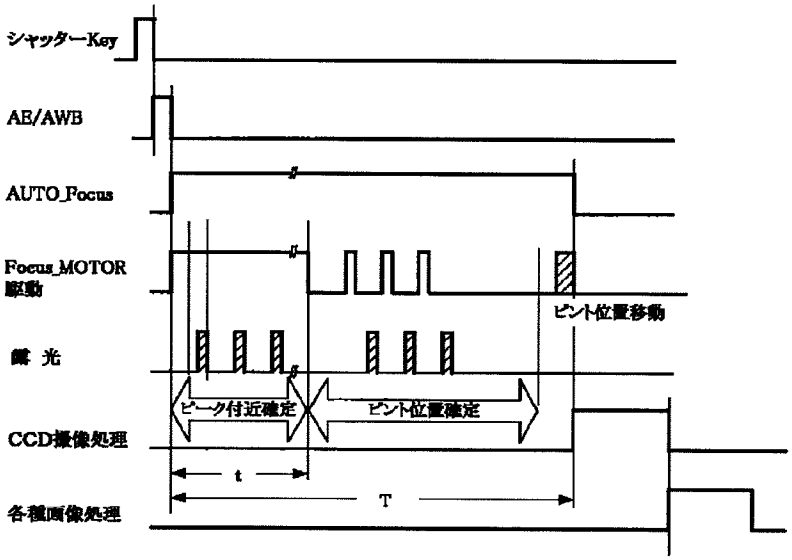

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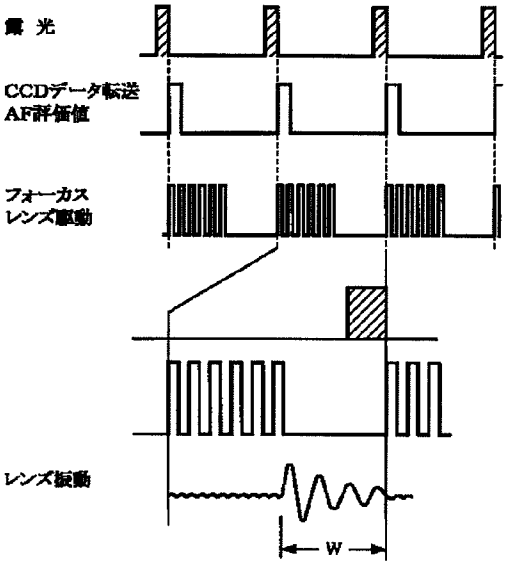
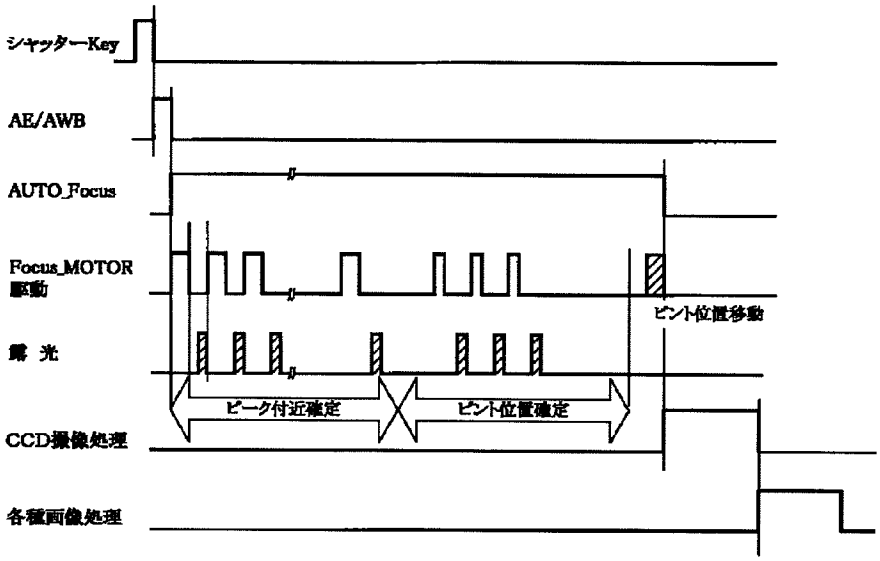
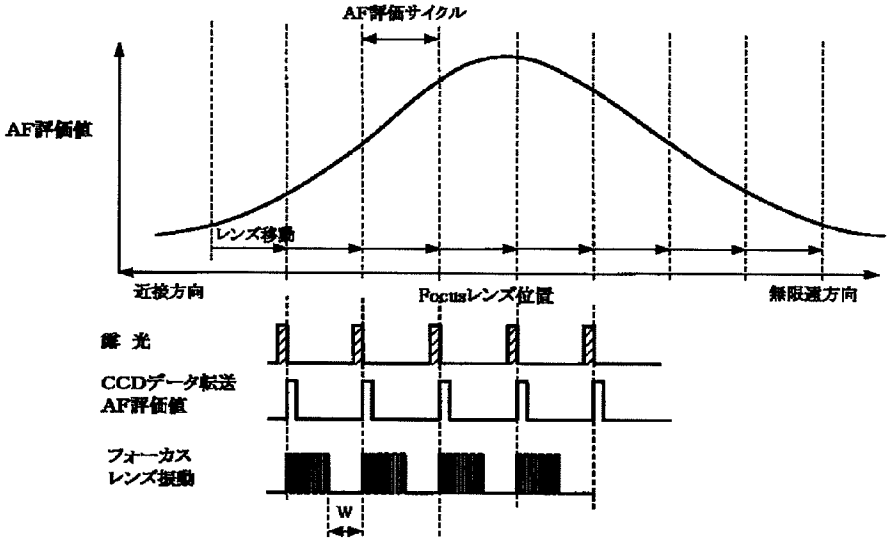


[Drawing 6]



[Drawing 7]



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(54)【発明の名称】　オートフォーカス方法、及びオートフォーカス装置

(57)【要約】
【課題】　コントラスト検出方式のオートフォーカス制御において、合焦位置の検出精度を大幅に低下させることなくＡＦ評価値のピーク位置をより短時間にて検出することが可能となるオートフォーカス方法、オートフォーカス装置を提供する。
【解決手段】　ステッピングモータによりフォーカスレンズを光軸方向に移動させながら、各位置でＣＣＤの出力信号に含まれる高周波数成分に基づきＡＦ評価値を算出し、それが最も大きくなるピーク位置へフォーカスレンズを移動する方式である。サーチ範囲内でのフォーカスレンズの移動を継続して行い、その移動途中に所定の周期でＣＣＤによる露光を行う。ＡＦ評価値を取得するＡＦ評価サイクルを短縮することにより、オートフォーカス動作の高速化を図ることができる。しかも、ＡＦ評価サイクル毎にフォーカスレンズの振動が増大しないため、オートフォーカス制御時のフォーカスレンズ等の動作音を低減させることができる。